Chapter 9:
Case Studies Illustrating of Design
Outline

• Smart Lighting
• Home Intrusion Detection
• Smart Parking
• Weather Monitoring System
• Weather Reporting Bot
• Air Pollution Monitoring
• Forest Fire Detection
• Smart Irrigation
• IoT Printer
Smart Lighting

A design of a smart home automation system:

• **Control** the **lights** in a typical home remotely using a web application.

• The system include **auto** and **manual** modes.
Smart Lighting

- Deployment design
Smart Lighting

• Mode service
Smart Lighting

• State service
Smart Lighting

- Controller service
Home Intrusion Detection

A design of home intrusion detection systems:

• **Detect intrusions** using sensors and **raise alerts**, if necessary.
• Each **door** has a door sensor to **detect opening of door**.
• Each **room** has a PIR motion sensor to **detect motion**.
Home Intrusion Detection

• Deployment design
Home Intrusion Detection

- Door service
Home Intrusion Detection

• Room service
Home Intrusion Detection

- Controller service
Smart Parking

A design of smart parking systems:

• Detect the number of empty parking slots to help drivers search parking space easily.
• Each parking slot have a sensor to detect whether the slot is empty or occupied.
Smart Parking

• Deployment of sensors
Smart Parking

• State service
Smart Parking

- Controller service
Weather Monitoring System

A design of a weather monitoring IoT system:

• Collect data on environmental conditions such as temperature, pressure, humidity and light in area using multiple end nodes.

• The end nodes send the data to the cloud where the data is aggregated and analyzed.

• The end nodes are equipped with various sensors (such as temperature, pressure, humidity and light).
Weather Monitoring System

• Deployment design
Weather Monitoring System

• Controller service
Weather Reporting Bot

A design of a weather reporting bot:

• Report weather information by sending tweets on Twitter.

• The end nodes are comprised of a Raspberry Pi mini-computer, temperature, pressure, humidity and light sensors. In addition to the sensors, a USB webcam is also attached to the device.

• To send tweets:
  • Using a Python library for Twitter called `tweepy`.
  • With `tweepy` we can use the Twitter REST API to send tweets.
Weather Reporting Bot

• Schematic diagram – device and sensors.
Weather Reporting Bot

• Screenshot of a weather update tweeted.
Air Pollution Monitoring

A design of an air pollution monitoring:

• Multiple nodes placed in different locations for monitoring air pollution in an area.
• End nodes: CO and NO\textsubscript{2} sensors
• Send data to the cloud database
• Visualizing the data with cloud-based application
Air Pollution Monitoring
Forest Fire Detection

A design of a forest fire detection:

- A number of monitoring nodes (end nodes) deployed at different locations in a forest.
- End nodes collect measurements (like temperature and humidity) to predict whether a fire has broken out.
- Use one coordinator node to collect all data from end nodes through XBee module.
- Coordinator service calls rest api to send data to cloud.
Forest Fire Detection
Smart Irrigation

A design of a smart irrigation:

- Multiple monitoring nodes (end nodes) placed in different locations for monitoring soil moisture.
- End nodes send data to cloud through Raspberry Pi.
- Cloud-based application visualize the data.
- A solenoid valve is used to control the flow of water, which connects to Raspberry Pi.
Smart Irrigation
A design of an IoT printer:

• Fetch daily briefing information (today’s weather prediction, ...) on the Internet.
• Login to the google calendar to fetch your schedule.
• Write to a file and then print every morning.
IoT Printer